SOUTHEAST GEORGIA 24-COUNTY ALTERNATIVE WATER SUPPLY STUDY

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Abstract. This paper summarizes the alternative water supply analysis performed as part of EPD's Sound Science Initiative for the 24-county coastal region of Georgia. The work included assessing surface water supplies, off-main stem surface water impoundments, and wastewater effluent reuse as sources of water in the 24-county area. These were evaluated as alternative water supplies to offset current Upper Floridan Aquifer withdrawals and to help alleviate the saltwater intrusion problem at Hilton Head, South Carolina and Brunswick, Georgia. The presentation will describe the evaluation process, which included using ArcView®, a geographic information system (GIS) developed by ESRI, to help analyze the data and rank the alternatives.

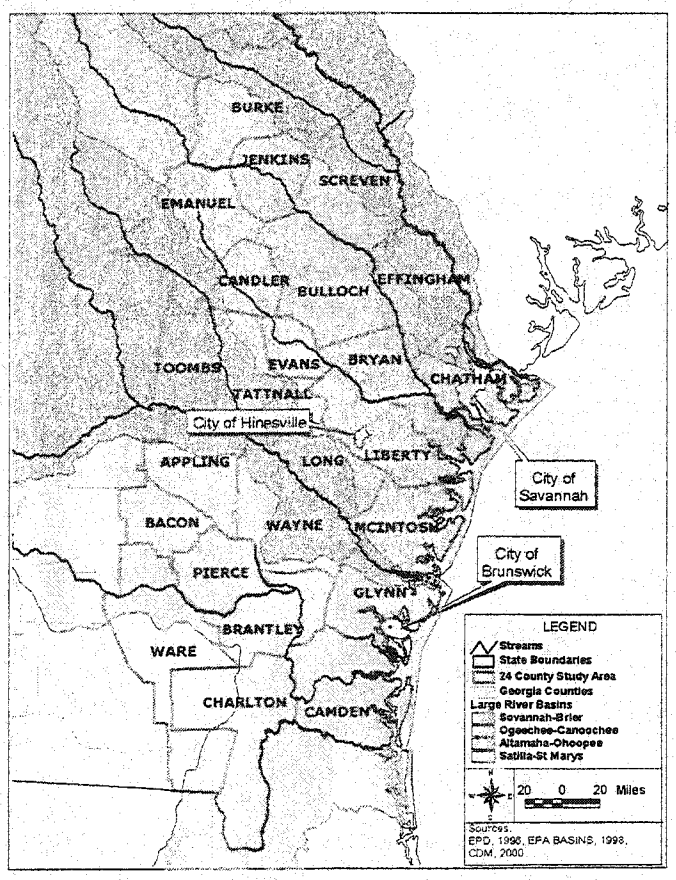

Figure 1. 24-county coastal area.

INTRODUCTION

The purpose of this study was to explore alternate sources of water in the 24-county area shown in Figure 1. Currently, the counties are primarily using groundwater supplies from the Upper Floridan Aquifer. These withdrawals have contributed to the saltwater intrusion at Hilton Head, South Carolina, and Brunswick, Georgia.

Three areas of alternate sources were considered in this study: surface water withdrawals from major rivers, reclaimed water reuse, and surface water impoundments. A fourth evaluation, water conservation opportunities, is presently ongoing. Opportunities for each alternative were sought throughout the 24-county area. However, some strategies were less appropriate to portions of the study area due to physical, geological, or other constraints. During each water supply analysis, potential sites were identified and reviewed for their characteristics, cost, and proximity to large users. The most optimal sites were then evaluated in greater detail and visited for field verification of collected data.

SURFACE WATER SUPPLY

Potential sites for surface water intakes were identified along the six principal rivers and their tributaries in the area:

- Savannah River
- Ogeechee River
- Canoochee River
- Altamaha River
- Satilla River
- St Marys River

Sixteen preliminary sites for surface water withdrawal were identified based on stream flow characteristics, proximity to users, distance to point discharges, and

potential water quality issues associated with non-point source pollution. Extensive stream flow analyses were conducted to determine the suitability of rivers for surface water withdrawal. River stage and flow were analyzed to evaluate each river's ability to support withdrawal at two withdrawal levels: 3 percent and 15 percent of average annual flow. Three percent was chosen because it was assumed to be within the accuracy of the gage data. Fifteen percent was chosen because even partial implementation of these withdrawals would support demand projections for 2050. Multiple low flow calculation methods were also used for comparative purposes. For surface water withdrawal sites where flow characteristics are less than optimal, groundwater can be used in conjunction with surface water to protect low-flow water uses in the stream.

Cost estimates were calculated to help compare costs of surface water and groundwater treatment. Using a 25-year revenue bond and 6 percent interest rate as a starting point for cost estimates, the total annual cost for a plant to produce 10 million gallons of water per day (mgd) was estimated at $3 million for surface water and $0.6 million for groundwater. Based on these cost estimates, surface water would cost customers $1.40 per thousand gallons in comparison to $0.28 per thousand gallons of groundwater. Cost differences between surface and groundwater treatment decrease with larger plant sizes. Therefore, the development of regional surface water plants to help serve areas around Savannah, Brunswick, and Hinesville may make the development of surface water supplies a more economically viable solution.

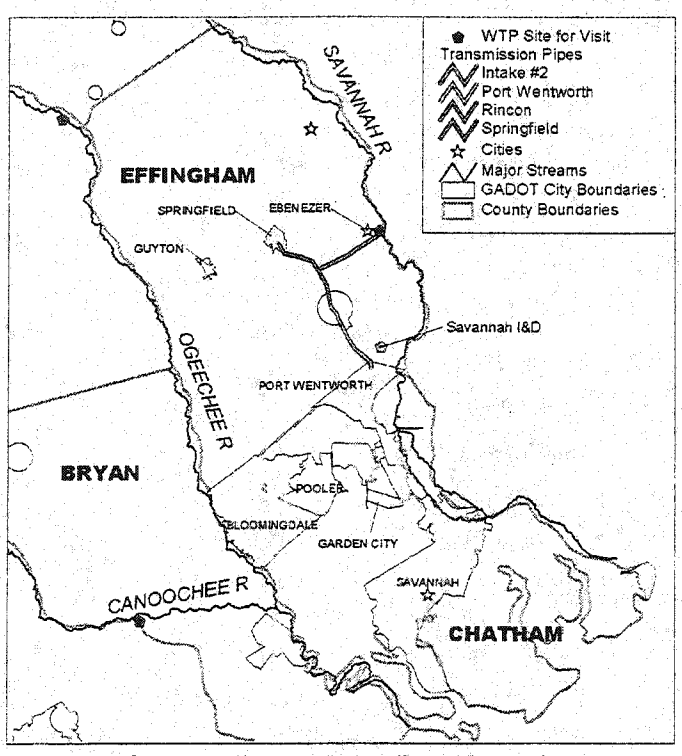

Figure 2. Example Transmission Pipe Network.

Detailed study and field visits were conducted for six of the sixteen sites identified for surface water withdrawal – one site on each of the principal rivers. Transmission pipe costs were estimated to develop regional surface water plants at the following locations:

- Savannah River near Ebenezer. This would serve the towns of Rincon and Springfield, and the peripheral areas of Savannah.
- Canoochee River near Hinesville. This would serve Hinesville, Fort Stewart, and surrounding areas.
- Altamaha River near Everett. This would serve Brunswick, St. Simons/Sea Island, and Jessup.

Major state roads were used in the GIS to estimate the length of pipe required to connect into the existing pipe network at larger towns. An example pipe network for the Savannah River regional plant is shown in Figure 2. Transmission pipe costs for the three sites to their major service areas were estimated at $5.3 million for the Savannah River site, $3.8 million for the Canoochee River site, and $10.1 million for the Altamaha River site.

RECLAIMED WATER REUSE

Application of reclaimed water reuse was analyzed primarily for irrigation of golf courses and agricultural irrigation. Review of agricultural irrigation focused on agricultural products for non-foods such as cotton or fruit/nut bearing trees where spray water would not reach edible fruits. Forty municipal water pollution control plants (WPCPs) and 49 golf courses were identified in the 24-county area. Golf courses were ranked based on their proximity to wastewater supplies, potential golf course demand, and wastewater supplies.

Five golf courses were visited to assess the opportunity for reuse application and determine design components of a reuse system necessary to serve these golf courses. The five golf courses were located on St. Simons Island in Glynn County and are shown in Figure 3. All five courses were served by the St. Simons Island Water Pollution Control Plant (WPCP).

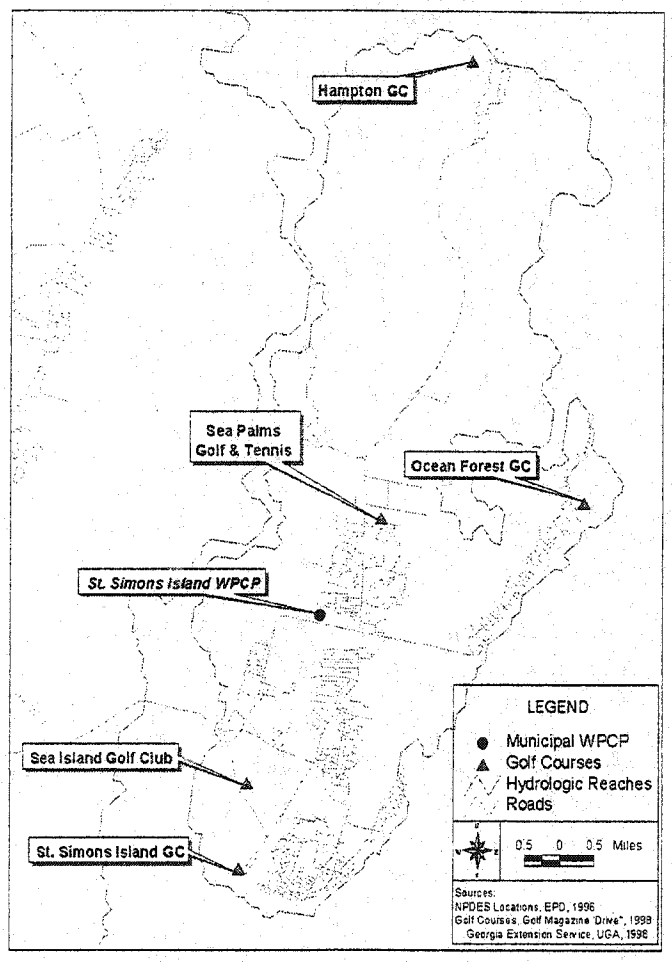

Figure 3. Golf Course Site Visits.

During site visits, it was established that all of the golf courses have or will have switched to the Miocene Aquifer for groundwater supplies. Therefore, reuse application at these sites will not offset groundwater pumping from the Upper Floridan Aquifer. All five golf course managers would be amenable to using wastewater effluent as a water supply provided:

- An alternate discharge was in place so that the golf courses would not be required to use the water when irrigation was not necessary
- The golf courses would not have to give up existing wells as a backup water supply source.

The City of Savannah's President Street Water Quality Control Facility (WQCF) was also visited as a potential supplier of reclaimed water. The Savannah President Street WQCF is currently providing reuse water to a golf course on Hutchinson Island. It was found that the system could be expanded to provide irrigation and other non-potable reuse water to the Savannah metropolitan area.

SURFACE WATER IMPOUNDMENTS

Potential surface water impoundment sites were identified for streams draining into the six principal rivers in the 24-county area. GIS techniques were used to help identify, characterize, and rank the 212 potential reservoir sites. Figures 4 and 5 present typical information used to evaluate the reservoir sites. Physical characteristics of the dams, reservoirs, and basins were calculated using a GIS, including:

- Elevation of the streambed at the dam centerline
- Elevation of the top of the flood pool
- Dam length at the flood pool elevation
- Area of reservoirs and corresponding drainage basins

Sites were eliminated during several evaluation phases based on the following characteristics:

- Potential yield of reservoir
- Reservoir volume and area
- Drainage area of reservoir
- Proximity to potential user based on straight line distance from dam to the center of the nearest municipality
- Potential usage based on 1998 groundwater withdrawals
- Percent agriculture in county
- Location relative to Gulf Trough
- Underlying soil type
- Wetlands impacts
- Water quality concerns

Reservoirs were ranked with weighted criteria to eliminate less favorable sites. Seven sites were then selected for site visits, in-depth site analysis, and revised conceptual day layouts. These sites were determined most favorable based on a comparison of dam and reservoir characteristics, physiography and streamflow, cultural and environmental impacts, supportable yield, cost, hazards, and proximity to users. The visited sites are located in the northwest counties of the study area where the most suitable topography and subsurface soils are found.

Estimated construction costs were calculated for the reservoirs, and ranged from $1.6 million to $5.6 million. Calculated yield ranged from 0.32 mgd to 1.2 mgd. Estimated cost per mgd of yield ranged from $3 million to $5.3 million. While the estimated costs of reservoirs were high, the actual land cost assessed

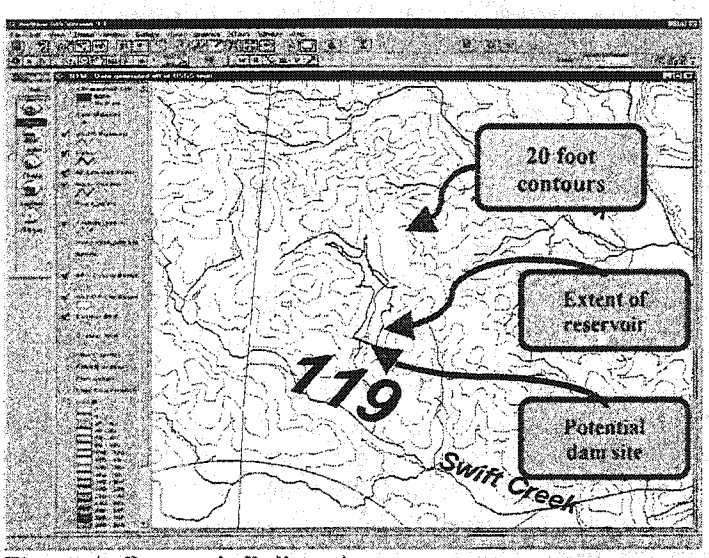

Figure 4. Reservoir Delineation.

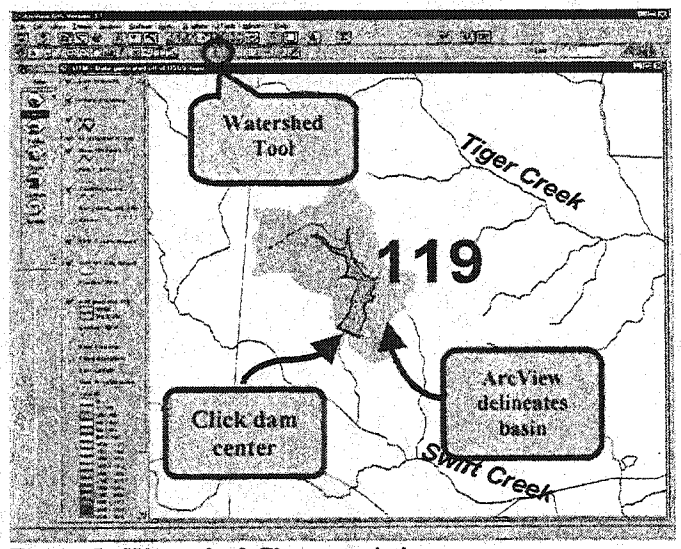

Figure 5. Watershed Characteristics.

during field visits was, on average, 75 percent lower than those used in developing the cost estimates. Where flow characteristics are less than optimal for surface water impoundments, pumped storage could be implemented as a supplement to the impounded stream's water supply. The use of pumped storage could also help reduce the reservoir's cost per mgd of yield.

CONCLUSIONS

There are several alternate water supplies in the coastal region of Georgia that could be developed to help alleviate saltwater intrusion in the region. These include developing surface water impoundments on smaller streams and tributaries, implementing wastewater effluent reuse, and building regional surface water supply plants. Surface water impoundments could be cost effective solutions for providing water to select locations, but are probably cost prohibitive for widespread application across the region. Wastewater effluent reuse should be implemented wherever possible and is especially viable in locations where several golf courses are located together. The development of regional surface water supply plants is the most economical method of providing surface water supplies. These can be implemented at select locations to provide water to several cities, towns, and industries. In these locations, the conjunctive use of groundwater and surface water should be implemented to prtoect in-stream minimum flows.

Overall, the study found that there is enough water in the coastal region to supply the growing demand, but costs may rise when supply shifts from groundwater to other sources. Regional surface water supplies will be able to provide the most water to the largest number of users. A combination of each method, based on economical and environmental factors, may be the best solution to solve the region's water supply problems.